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## PATENT ABSTRACTS OF JAPAN

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(72)Inventor : ITO YOSHIKUNI

## (54) IMAGE FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To print on an OHP sheet without deteriorating the image surface due to beading by giving ink containing specific amount of surfactant in a specific range to a medium to be recorded having a porous ink receiving layer containing alumina hydrate and binder as main components.

SOLUTION: An ink jet recording system has a plurality of recording elements placed side by side and forms an image by scanning in the direction different from the juxtaposing direction. In this case, an image can be formed without generating beading even in the case of printing on an OHP sheet by giving ink containing 0.2 to 5.0wt.% of surfactant to a medium to be recorded having a porous ink receiving layer containing alumina having a boehmite structure and binder as main components on a base material at  $3 \times 10^{-3}$  to  $8 \times 10^{-3}$  mg/mm<sup>2</sup> sec. In this case, when the ink containing the surfactant is recorded on the medium, the printing time interval per unit amount of the ink is increased to form a color image.

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**CLAIMS**

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[Claim]

[Claim 1] In the image formation technique by the ink-jet formula which scans the record head which carried out the juxtaposition of two or more record elements in the orientation different from two or more preparations and this record element juxtaposition orientation, and forms a picture image As opposed to the record medium-ed with the porous material ink acceptance layer which makes a principal component the hydrated alumina which has Boehmite structure on a base material, and a binder The image formation technique characterized by giving the ink which contains a surfactant 0.2 to 5.0% of the weight in the domain of  $3 \times 10^{-3} \text{mg/mm}^2 \text{sec}$  -  $8 \times 10^{-3} \text{mg/mm}^2 \text{sec}$ .

[Claim 2] The image formation technique given in the claim 1 characterized by forming a color picture by scanning of multiple times to the same scanning field when recording the ink containing the aforementioned surfactant to the aforementioned record medium.

[Claim 3] The claim 1 characterized by making the printing time interval per unit quantity of ink increase, and forming a color picture when recording the ink containing the aforementioned surfactant to the aforementioned record medium, or the image formation technique given in 2.

[Claim 4] The image formation technique given in the claims 1-3 which make heat energy act on ink and make an ink drop breathe out.

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## DETAILED DESCRIPTION

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[Detailed description]

[0001]

[The technical field to which invention belongs] this invention relates to the image formation technique for the record medium for ink jets-ed with the porous material ink acceptance layer which makes a principal component the hydrated alumina which has Boehmite structure especially on a base material about the image formation technique recorded using ink, and a binder.

[0002]

[Prior art] In recent years, an ink-jet recording mode makes the minute droplet of ink fly from a minute nozzle by various working principles, was made to adhere to record media-ed, such as paper and OHP sheet, records a picture image, a character, etc., had which characteristic feature with easy formation of small lightweight, improvement in the speed, reduction in an ambient noise, color-izing, etc., as a recording device of various picture images, begins an information device and began to be used for various kinds of intended use.

[0003] In an office, it is spreading easily [ the beautiful ink jet printer of ink coloring ], and quickly in connection with the spread of personal computers for a creation of OHP sheet for presentations as the outgoing end end of CG of the document created with the personal computer, various graphics, and a pictorial picture image.

[0004] The picture image furthermore formed by the full color ink-jet formula also as industrial use is possible also for obtaining the record for which multicolor printing and the silver salt photograph formula by the platemaking formula are also pressed, in variety little number-of-copies printing, is cheap, and is suitable for it rather than it is based on usual multicolor printing. Moreover, it is applied also to the field of textile printing which records directly the design created by computer on the cloth for garments etc.

[0005] Moreover, although the coat paper had to be conventionally used as a record medium-ed in the ink-jet formula, the width of face of the record medium for the ink jets for offices-ed is also spreading, a thing recently recordable also in the so-called regular paper (a regular paper copying machine form or PPC form) begins to be demanded, and the regular paper correspondence ink jet printer which improved record ink has also begun to appear.

[0006] OHP sheet for ink jet printers is the configuration of generally having prepared the ink absorption layer on base materials, such as transparent PET. An ink absorption layer has the type of adsorbing a color by the thing of the resin absorption type swollen including ink, and the type which holds ink by the void of a porous layer or an electrostatic attraction. Furthermore, it is a thing adapting OHP sheet for ink jet printers, and the high-gloss film of the photograph tone which made the transparent base material of OHP sheet the white base material is also put on the market. There are followings as ink improved by regular paper correspondence. In order to improve the permeability of ink in a Provisional-Publication-No. 029546 [ 55 to ] official report, and a publication-number 43291 [ three to ] official report, the ink for a record which added the surfactant in ink is indicated. In this ink, ink absorption when printing in a regular paper is performed quickly.

[0007] Drawing 1 is the outline perspective diagram of the ink-jet recording device concerning the conventional example. The recorded material 5 rolled in the shape of a roll in drawing 1 is \*\*\*\*ed with the conveyance roller 3 through the conveyance rollers 1 and 2, and is sent in the orientation of f in drawing in connection with a drive of the vertical-scanning motor 50 combined with the conveyance roller 3. This recorded material 5 is crossed, guide rails 6 and 7 are placed in parallel, and the record head unit 9 carried in carriage 8 scans right and left. The heads 9Y, 9M, and 9C of yellow, a Magenta, cyanogen, and four colors of black and 9Bk are carried in carriage 8, and the ink tank of four colors is arranged at this. Although the print width [ every ] intermittent feed of the record head 9 is carried out, when the recorded material 5 has suspended the recorded material 5, the record head 9 is scanned in the orientation of P, and carries out the regurgitation of the ink drop according to the picture signal.

[0008]

[Object of the Invention] Although there is an advantage which can print the aforementioned ink in the regular paper with the to some extent high degree of size, in performing a high-speed printing in the porous material ink acceptance layer which makes a principal component an alumina like OHP sheet, and a silica material using this ink, the problem that ink absorption becomes bad on the contrary, or a beading occurs arises. In order to make especially permeability high -- near critical micelle concentration -- until -- in the ink which made concentration high, the printed ink component condenses in an ink acceptance layer, and it is easy to generate a beading

[0009] A beading is two or more ink droplets printed by the record medium-ed condensing with surface tension on a record medium-ed in an absorption process, and becoming a big droplet here, and if this occurs, the concentration unevenness of bead-like ink will arise in a record picture image, and it will lead to a picture image degradation.

[0010] The purpose of this invention is to offer the image formation technique which a beading does not generate even if it prints on OHP sheet using the ink corresponding to the regular paper.

[0011]

[The means for solving a technical problem] The above-mentioned purpose is attained by the following invention. Namely, this invention is set to the image formation technique by the ink-jet formula which scans the record head which carried out the juxtaposition of two or more record elements in the orientation different from two or more preparations and this orientation of a record element juxtaposition, and forms a picture image. As opposed to the record medium-ed with the porous material ink acceptance layer which makes a principal component the hydrated alumina which has Boehmite structure on a base material, and a binder It is the image formation technique characterized by giving the ink which contains a surfactant 0.2 to 5.0% of the weight by  $3 \times 10^{-3}$  mg/mm<sup>2</sup>sec -  $8 \times 10^{-3}$  mg/mm<sup>2</sup> sec.

[0012]

[Gestalt of implementation of invention] According to an invention-in-this-application person's experimental result, it is easy to generate by the late medium of the ink absorption like especially OHP sheet, and a beading becomes easy to be conspicuous when the amount of ink printed by per a unit area and unit time on a record medium-ed increases. Moreover, when left by the aforementioned OHP sheets by the high-humidity/temperature environment, it found that an ink absorptivity might fall and a beading might also become remarkable by degradation of an absorption layer with the passage of time. This experiment is explained in detail below.

[0013] In the ink-jet recording device which makes heat energy act on the ink of aforementioned drawing 1, and makes an ink drop breathe out, duty printed the gradation pattern of equal 16 phases to OHP sheet for CJ10 by Canon, Inc. from 0% of the minimum values to 200% (2 color solid) of maximums on the record head (per mm about 16 nozzles) of 400dpi, and the ink regurgitation frequency of 4kHz. Duty 100% is the amount of the maximum ink of per record head 1 piece (=1 color), and it is 2 1mm. The ink drop of 16x16 hits is printed. ink -- containing -- having -- a surfactant -- an amount -- 0.1 -- % -- 0.2 -- % -- 1.0 -- % -- five -- % -- seven -- % -- having changed -- a printing -- (-- a --) - (-- e --) -- obtaining -- having observed. The surfactant used \*\*\*\*\* Norian 465 (tradename) by the \*\*\*\* chemistry company of a Nonion system.

[0014] In (a), although the beading was not generated, it was the order of (b) to (e), and beadings occurred frequently gradually and the picture image became bad as duty became high. That is, it was observed that a picture image becomes bad by the beading with the increase in the amount of ink printed per an increase and unit area of the amount of the surfactant contained in ink.

[0015] Next, the surfactant content in use and ink also made the same record head as the aforementioned experiment, the ink regurgitation frequency, and OHP sheet the identity ((a) - (e)), and 200%, all duty printed the printing time difference of one amorous glance and two amorous glance as 1 second, 2 seconds, and 3 seconds, and observed the picture image. (a) The beading was seldom conspicuous and the beading was observed for 1 or 3 seconds of (e) for 1 and 2 seconds of (d) for 1 second of (a) - (c) in 3 seconds (2, 3 seconds of - (c), and (d)).

[0016] This result (a) - (e) It turns out that a degradation of the picture image according [ the way which lengthened printing time difference on the whole ] to a beading is small. That is, when printing the ink of a certain constant rate, it turns out that the way with few amounts of ink printed to per unit time is good about a beading.

[0017] It was considered that it can make a beading mitigate by holding down a unit area and the amount of ink printed by per unit time from the above experiment to a certain within the limits. Specifically, since the content of the surfactant of ink made the beading mitigate till printing time difference 2 seconds at 0.1 - 5.0% A unit area and the amount of ink printed by per unit time are  $(30 \times 10^{-6} \text{ mg} \times 16 \times 16 \text{ pieces } [\text{mm}] \times 2 \times 2 \text{ color}) / 2 \text{ second} = 7.68 \times 10^{-3}$ , using one ink drop as  $30 \times 10^{-6} \text{ mg}$ . It is set to [mg/mm<sup>2</sup>sec].

[0018] Although it becomes the cure against a beading to enlarge 0.1 - 5.0% and printing time difference from picture

image quality, the record head fitness, etc. when printing in a regular paper, since the surfactant concentration of ink will drop the printing speed of the mainframe of image recording equipment, it becomes 2 seconds at most. However, 0.1% of the concentration of a surfactant is unsuitable at regular paper fitness evaluation so that it may mention later. moreover -- since, as for the lower limit of the amount of ink, a solid printing is buried --  $3.0 \times 10^3$  It was judged as [mg/mm<sup>2</sup> sec]. As a surfactant used by the technique of this invention, a Nonion system is desirable.

[0019] [Example] Hereafter, although an example explains this invention concretely, this invention is not limited to these.

[0020] A printer head consists of head 9Bk of head 9M of head 9C of cyanogen, and a Magenta, head 9Y of yellow, and black like drawing 2, it has 128 record elements at intervals of the nozzle of 16 rates in 1mm, respectively, and record element number No.1-No.128 are attached to each record element. The ink-jet heads 9C, 9M, and 9Y arranged like drawing 2 and 9Bk perform full color image recording, performing a serial scan.

[0021] Moreover, 1mm<sup>2</sup> The amount of printing ink in 2 color printing was made the monochrome printing [ twice ] into 200%, having used the amount of ink of the monochrome printing by 16x16 dots of hits as 100%. In the flow rate of ink, in the example of a printing control without specification, about 30 ngs and the regurgitation frequency of ink performed the ink-jet record as 4kHz per printing of 1 dot.

[0022] ink color Y : C.I. -- direct -- yellow 86M : C.I. acid red 35C : C.I. -- direct -- blue 199Bk : C.I. hood black 2 surfactant \*\*\*\*\* Norian 465 (tradename) and \*\*\*\* chemistry company make Ink composition 1 (monochrome ink, each weight section)

Color : The three sections Diethylene glycol : The five sections Polyethylene glycol : The ten sections Water : The 82 sections Ink composition 2 (monochrome ink, surfactant addition, each weight section)

color ink c : 1.0 section ink d : 80 section-surfactant 5.0 section ink e : Addition [ 7.0 section diethylene-glycol : / 5 section polyethylene-glycol : / 10 section water : ] : The five sections (section) Surfactant: Ink a : The 0.1 sections Ink b : The 0.2 sections

OHP sheet regular paper proper evaluation ink absorption time for CJ made from OHP sheet key \*\*\*\*\*, Inc.10 considered the early thing to be regular paper proper \*\*\*\*, and when there was no offset in piles about other papers immediately after a printing and O and offset occurred, it considered as x. This was uniquely decided with the amount of the surfactant contained in ink. That is, surfactant : 0.1 sections : x The 0.2 sections, the 1.0 sections, the 5.0 sections, 7.0 sections : O beading evaluation beading level formed the adult reference level A-E from smallness, and ranked the beading of an observed sample as A-E as compared with these. It is D which corresponds to \*\*\*\* at A-C, and \*\*\*\*\* and E are unsuitable.

[0023] In example 1 this example, the Magenta 100% ink of a total of 200% was printed cyano 100% using the aforementioned printer. The printing of a printing of one line was performed with two scans (two pass printing).

[0024] Based on drawing 3, a two pass printing is explained in detail. 1 scan scale division print only cyanogen and a Magenta is not printed ( drawing 3 of 1st line 1 scan scale division). A head scans time with it being the same to a recorded material, 2 scan scale division also print only a Magenta shortly, and cyanogen does not print them ( drawing 3 of 1st line 2 scan scale division). It means that the printing of the cyanogen of the 1st line and a Magenta was made now. That is, one line will be printed with 2 times of scans.

[0025] Next, only the width of face of a head carries out feed of the recorded material in the orientation of vertical scanning, and a printing of the 2nd line is performed. In 1 scan scale division, cyanogen ( drawing 3 of 2nd line 1 scan scale division) and 2 scan scale division print the Magenta ( drawing 3 of 2nd line 2 scan scale division) of the 2nd line like the 1st line. A two pass printing performs a full color printing by repeating this after the 2nd line to the last line.

[0026] On the other hand, an one-pass printing is a usual serial scan printing, and is printed with one line one scan. That is, a two pass printing will be printed in time when it is twice many as an one-pass printing. In this example, evaluation of the beading shown in Table 1 was obtained using ink b, c, and d.

[0027] Except having used example of comparison 1 ink a and e, the same printing as an example 1 was performed, and the beading evaluation shown in Table 1 was obtained.

[0028] Using example of comparison 2 ink a-e, the amount of printing ink was changed, as shown in Table 1, and the beading evaluation shown in Table 1 like an example 1 was obtained except having performed the printing by one-pass printing.

[0029] In example 2 this example, the Magenta 100% ink of a total of 200% was printed cyano 100% like the aforementioned example 1 using the aforementioned printer. this example -- a printing of one line -- two scans -- carrying out (two pass printing) -- although it is the same as that of an example 1 at the time, the modality and the amount of ink which are printed with each scan differ from each other That is, although the example 1 was the

two pass printing for every color like [ 1 scan scale division / with cyanogen and 2 scan scale division ] the Magenta, in this example, Magenta 50% is printed cyano 50% by 1 scan scale division, and Magenta 50% is printed the remaining cyano 50% in 2 scan scale division. in every 50% of a printing, 1 scan scale division print a dot alternately, I understand that it is reverse alternate alike and 2 scan scale division are printed, and there are so that it may be complemented As a result of printing three kinds of ink b, c, and d in which the content of a surfactant is different by the printing control technique of this example 2, it became as it is shown in Table 1.

[0030] Except having used example of comparison 3 ink a and e, it printed like the example 2 and the result shown in Table 1 was obtained.

[0031] It is the printing control technique of having considered all as the one-pass printing in examples 3 and 4, four to example of comparison 7 this examples 3 and 4, and the examples 4-7 of a comparison, and having changed the regurgitation frequency of the ink which was 4kHz in the examples 1 and 2. In the example 3 and the example 4 of a comparison, it could be [ 6kHz and the example 7 of a comparison ] 8kHz by 1kHz and the example 6 of a comparison in 2kHz, the example 4, and the example 5 of a comparison. As a printing picture image becomes the same at this time, compared with the example 2 of a comparison, in the example 3, it drops to 1/2, and a scanning speed of a head drops [ 1.5 times and the example 7 of a comparison ] twice by the quadrant and the example 6 of a comparison in the example 4.

[0032] As a result of printing five kinds of ink a, b, c, d, and e to which the content of a surfactant was changed by the printing control technique of the examples 3 and 4 and the examples 4-7 of a comparison, it became as it is shown in Table 1.

[0033] examples 5 and 6 and the examples 8-13 of a comparison -- in these examples and the example of a comparison, it is the printing control technique of the one-pass printing to which the flow rate of the ink which was 30ngs was changed in the examples 1 and 2 the example 5 and the example 8 of a comparison -- in 10ngs, the example 6, and the example 9 of a comparison, it was referred to [ 25ngs and the example 12 of a comparison / 35ngs and the example 13 of a comparison ] as 40ngs by 20ngs and the example 11 of a comparison in 15ngs and the example 10 of a comparison. As a result of printing five kinds of ink a, b, c, d, and e to which the content of a surfactant was changed by such printing control technique, it became as it is shown in Table 1.

[0034]

[Table 1]



表 1

	印字インク量 $\times 10^{-3} \text{ mg/mm}^2 \text{ sec}$	ビーディング				
		インク a	インク b	インク c	インク d	インク e
実施例 1	7. 6 8	—	A	B	C	—
比較例 1	7. 6 8	A	—	—	—	D
比較例 2	1 5. 3 6	A	B	D	E	E
実施例 2	7. 6 8	—	A	B	C	—
比較例 3	7. 6 8	A	—	—	—	D
実施例 3	7. 6 8	—	A	B	C	—
比較例 4	7. 6 8	A	—	—	—	D
実施例 4	3. 8 4	—	A	A	B	—
比較例 5	3. 8 4	A	—	—	—	D
比較例 6	1 1. 5 2	A	B	C	D	D
比較例 7	1 5. 3 6	A	B	D	E	E
実施例 5	5. 1 2	—	A	A	C	—
比較例 8	5. 1 2	A	—	—	—	D
実施例 6	7. 6 8	—	A	B	C	—
比較例 9	7. 6 8	A	—	—	—	D
比較例 10	1 0. 2 4	A	B	C	D	D
比較例 11	1 2. 8 0	A	B	D	D	E
比較例 12	1 7. 9 2	B	C	D	E	E
比較例 13	2 0. 4 8	B	C	D	E	E
普通紙適正		×	○	○	○	○

as shown in Table 1, in spite of being \*\*\*\*\* (A) in respect of a beading in the domain, as for 0.1 \*\*\*\*\* ink a, the amount of printing ink indicates a surfactant to be to front Naka -- a regular paper -- since it is disqualification, if it is proper, and it synthesizes -- use -- it is unsuitable the domain, as for 7.0 \*\*\*\*\* ink e, the amount of printing ink indicates a surfactant to be to front Naka -- all -- the point of a beading -- use -- it is unsuitable The amount of printing ink is evaluation of A-C in respect of a beading in the domain of 3.84-7.68 front Naka indicated the surfactant to be like examples 1-6 in the 0.2 sections, the 1.0 sections, and 5.0 \*\*\*\*\* ink b, c, and d, respectively, regular paper proper \*\* is good and it is clear that it is \*\*\*\*\*.

[0035]

[Effect of the invention] As explained above, even if it prints on OHP sheet using the ink corresponding to the regular paper according to the technique of this invention, beautiful image recording without a degradation of the screen by the beading can be performed.

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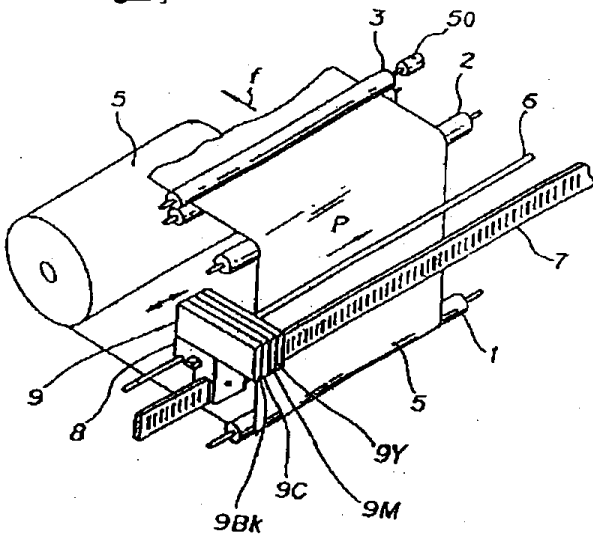
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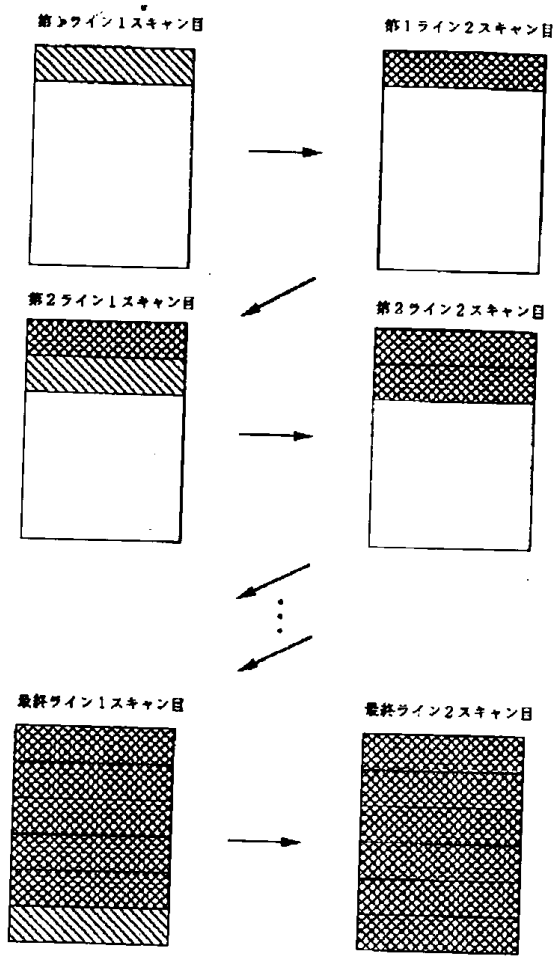
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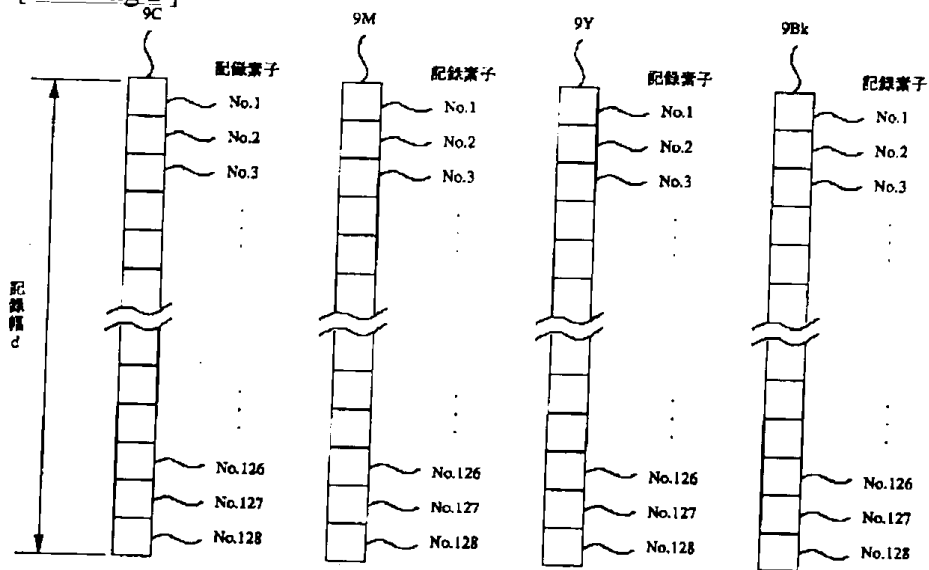
[ Drawing 1 ]



[ Drawing 3 ]



[ Drawing 2 ]



[Translation done.]